Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
AT&T Petition to Launch a Proceeding	)	GN Docket No. 12-353
Concerning the TDM-to-IP Transition; Petition of	)	
the National Telecommunications Cooperative	)	
Association for a Rulemaking to Promote and	)	
Sustain the Ongoing TDM-to-IP Evolution	)	

COMMENTS OF ALCATEL-LUCENT

Kevin Krufky, Vice President
Jeffrey Marks, Sr. Counsel – Director
Regulatory Affairs

Public Affairs, Americas Region
1100 New York, Avenue, N.W.
Suite 640 West Tower
Washington, D.C. 20005

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Alcatel-Lucent submits these comments in response to the above-captioned proceeding concerning the TDM-IP transition.

I. INTRODUCTION AND SUMMARY

Alcatel-Lucent is the trusted transformation partner of communications service providers, enterprises, and strategic industries worldwide, providing solutions to deliver voice, data and video communications services to end-users. A leader in fixed, mobile and converged broadband networking, IP and optics technologies, applications and services, Alcatel-Lucent leverages the unrivaled technical and scientific expertise of Bell Labs, a leading innovator in the communications industry.

Alcatel-Lucent's Bell Labs has a world-class patent portfolio covering a broad spectrum of technology, with some 45,000 patent assets, including more than 30,000 issued patents and some 15,000 applications. Specifically, these patents span the telecommunications ecosystem, including fixed line and wireless communications, semiconductors, consumer electronics, multimedia, optical, software, cloud computing, applications and network security. The following products represent some of Alcatel-Lucent's technological breakthroughs since 2010, alone:

- lightRadio™ – a groundbreaking wireless small cell technology capable of 2G, 3G, and 4G services, small enough to fit in a hand, which promises to radically streamline and simplify mobile networks;

- 100G optical transmission – 100 Gigabit per second optical transmission and IP routing;

- DSL Phantom Mode – boosts the transmission speeds of copper DSL by 50%; and

- FP3 Processor – the world's first 400G network processor, which unlocks value for the next generation of online applications, entertainment and communications, while cutting power consumption by up to 50%.

Alcatel-Lucent has a long history of providing and maintaining telecommunications carriers' voice networks for more than 100 years with its industry leading digital Class 4/5 switching platforms, deployed in over 50% of U.S. carriers' traditional Public Switched Telephone Network (PSTN) footprint. Alcatel-Lucent is a major leader in fixed and wireless IP voice services, including:

- Digital Subscriber Line (DSL) and Fiber-to-the-Node (FTTN): One out of three broadband subscribers access the internet through Alcatel-Lucent DSL equipment; over 90 VDSL2 (the latest in DSL technology) deployments and trials.

- Fiber-To-The-Home (FTTH): 160+ deployments, including Gigabit Passive Optical Networking (GPON), Ethernet Passive Optical Networking (EPON), and Point-to-Point (P2P) fiber technology.

- IP Multimedia Subsystem (IMS): 105 deployments globally; 64 active customer engagements with 43 supporting live traffic, including 5 in North America.

- Long Term Evolution (LTE): 33 deployments and over 40 trials, including in North America where three national carriers rely on Alcatel-Lucent LTE in their networks.

- Services: 50 million IMS subscriber licenses, 15 million Voice over LTE (VoLTE) licenses, and 7 million Rich Communication Services (RCS)-based Presence licenses.

As a leading supplier of Time Division Multiplexing (TDM) and Internet Protocol (IP) voice platforms, Alcatel-Lucent is in a unique position to comment on and address the transition from legacy PSTN infrastructure to IP infrastructure.

In considering a transition from the PSTN to an all-IP environment, Alcatel-Lucent encourages the Commission to consider voice services not solely in the context of those provided by the legacy PSTN, but the breadth of increased user functionality that adjoins the introduction of new IP-enabled voice services. As the market for PSTN voice services continues to erode, the challenge of operating and maintaining outdated legacy platforms is increasingly unsustainable. Furthermore, current regulatory obligations that require carriers indefinitely to serve a small subset of customers using legacy systems runs counter to the overwhelming consumer demand for IP-enabled platforms and the new services those platforms enable.

In light of enhanced consumer functionality in an all-IP environment, and the prohibitive costs associated with maintaining an underutilized legacy infrastructure, Alcatel-Lucent urges the Commission to review regulations, policies and technology to ensure the nation transitions from the PSTN to an all-IP environment in a timely manner that is also seamless to consumers. As part of this initiative, Alcatel-Lucent supports PSTN transition trials as a key step in understanding how best to implement the transition for the Nation at large.

II. TRANSITIONING TO AN ALL-IP ENVIRONMENT WILL BENEFIT CONSUMERS AND THE MARKETPLACE

The communications marketplace is moving toward a new digital lifestyle empowered by highly intuitive, customizable, and personalized tools. As a result, service providers are moving away from offering traditional inflexible and static mass market services. The evolution underway in the market, made possible by the introduction of IP-enabled services, allows telecommunications carriers to offer best in class digital communication experiences.

In the context of new voice services, IP networking allows for the creation of new personalized services and features that simplify the ability for others to “reach me.” There are

many examples, including capabilities such as “Simultaneous Ring,” “Find Me, Follow Me,” “Time-of-Day Reach Me,” and more. In many cases, IP services can enable a user’s presence information or calendar information to determine the best method to reach them. These next-generation IP networks and single number services work across all of a user’s fixed and mobile devices.

Additional new capabilities are those that provide interfaces that make existing and new features much easier for consumers to use. They provide users with the ability to manage their features from an easy to use interface such as a web portal. Being able to use supplemental call features like call forwarding, click-to-call, turning on and off calling ID presentation, or setting up a screening list from an intuitive Graphical User Interface (GUI) is much simpler than trying to remember “star-codes”. In essence, the richness of the IP communications experience is enhanced (through IP networking) by making the services intuitive and easy to use.

Application Programming Interfaces (APIs), and an open environment encouraging their use by applications developers, is driving continued web and mobile service innovation as well. Consumers and enterprises alike are benefitting from features such as in-home connectivity, improved quality of experience, new managed services, unprecedented content and multi-media availability, robust third party applications, fixed mobile convergence, smart home services, and automated customer and support services. Across the world, Alcatel-Lucent is observing a rapid shift to this new global, connected digital lifestyle, creating deep societal and economic changes (as well as economic uncertainties for those countries not embracing it). The migration and eventual sunset of TDM switching assets in favor of new IP-enabled services platforms produces a single services infrastructure that allows carriers to offer connected services across their user base. With estimates of over 5 billion internet users and 50 billion connected devices projected

by 2020[1], the end user experience means being connected. IP voice service, and its replacement of legacy PSTN voice service, is a step towards further enabling that connected experience. An all-IP infrastructure operating on the principles of the Internet makes it much easier and less costly to operate networks while unifying a secure, feature-rich communications experience across fixed and mobile networks.

Conversely, the effects of operating an underutilized legacy network weigh heavily on a telecommunications carrier's business and ability to invest in IP. As PSTN voice service attrition continues, the inefficiency of the PSTN platform continues to grow. A large carrier supporting 30 million or more TDM connected lines may have as many as ten thousand switch nodes that make up their PSTN network. Many of these switch nodes are operating with more than 70% of capacity unused. Nonetheless, these substantially underutilized assets continue to draw energy, require ongoing maintenance and operations support. A market area serving over 6 million subscribers operating at 30% capacity wastes over $100 million in energy costs each year. The benefits of consolidating and retiring underutilized resources are evident.

It is critical for the U.S. telecommunications marketplace to transition away from legacy networks. The consumer benefits in an all-IP environment. The marketplace benefits by decommissioning costly legacy platforms. The migration from and sunset of TDM switching assets in favor of new IP-enabled services platforms are in the best interests of consumers and the marketplace alike.

[1] See, e.g., http://www.networkworld.com/news/2010/010410-outlook-vision-predictions.html?page=1 and http://www.electronicsweekly.com/Articles/08/01/2013/55323/fifty-billion-internet-nodes-predicted-by-2020.htm

III. THE ONGOING EVOLUTION FROM TDM TO IP NETWORKS

Traditional TDM switched voice networks were not built to support the current influx of new smart devices, services and applications for voice, data and video. Consumers are accessing these new IP services through high-speed broadband infrastructure, a trend that will continue for the foreseeable future.

Alcatel-Lucent has played a central role in the ongoing transition from TDM to IP worldwide, including in the U.S., with major IP deliveries including AT&T's U-Verse network and Verizon's FiOS network. Last year, IP extension shipments outperformed TDM extensions by a wide margin as a consequence of key global IMS deployments; North America lead in the transition to IP networks. These trends point to overwhelming consumer acceptance of broadband and IP services and the actions carriers are taking to meet the demand at both the access and service layers. Similarly, industry is seeing traditional TDM voice services decline at rates as highs as 10% per year, leaving the installed base of Class 5 switch equipment operating at less than two-thirds of its initial engineered capacity. According to some estimates[2], by the end of 2012 no more than one-third of households purchased traditional TDM switched voice service from Incumbent Local Exchange Carriers.

Key Drivers promoting carrier investment in IP transformation include:

- IP Services Evolution and Competition: Consumers will benefit from new and innovative services that the TDM infrastructure cannot provide, and new investment may offer additional potential benefits to customers (e.g., IMS providing common fixed and mobile voice services); the level of interest in investing in PSTN migration is also impacted by service providers' need to account for migration from fixed to mobile voice service, and

[2] *See*, e.g., http://www.ustelecom.org/blog/new-fcc-data-support-ustelecom-non-dominance-petition

the extent to which competitors are winning subscribers due to a wider variety of voice capabilities made possible by an IP environment.

- Equipment Obsolescence: Most legacy TDM platforms are approaching 40 plus years in age and for most, if not all manufacturers, the platforms are discontinued; resources (expertise) and equipment spares are becoming scarce. In situations where the original vendor is no longer in business and no support or spares are available, carriers' are often forced to migrate from their legacy silo model to a new voice platform, even without guaranteed return on investment.

- Government Initiatives: A critical variable in PSTN migration is the regulatory treatment of voice services. In many areas of the world today, regulators are incentivizing access network upgrades, especially to fiber. As a result, some carriers are actively accelerating subscriber departure from the legacy PSTN by offering fewer voice services, or by promoting unregulated voice services (e.g., facilities-based VoIP as part of a triple play offering). Other carriers are reluctant to migrate away from the PSTN to the extent the legacy network is in some fashion protected or subsidized and a new network is not.

Governments around the world increasingly appreciate that IP services delivered through high-speed broadband infrastructure deliver numerous socio-economic benefits and have therefore been defining aggressive broadband plans in an attempt to realize those benefits; for example, the European Digital Agenda strives to achieve 30 Mbps for all and 100 Mbps for half of European households by 2020; Plano Nacional in Brazil seeks to provide broadband to 90 million people by 2014; the National Backbone in India will deliver broadband to 90% of the population by 2013; the twelfth 5-year plan in China will support 250 million new subscribers with an average speed of 20 Mbps by the end of 2015; the Australian National Broadband

Network (NBN) program will connect all Australians to high-speed Internet access services by 2020; and the New Zealand Ultra Fast Broadband (UFB) program will provide 100 Mbps to 75% of the population by 2020. In the United States, the Commission's own National Broadband Plan called for 100 million U.S. homes to have affordable access to Broadband Internet access download speeds of at least 100 Mbps and upload speeds of at least 50 Mbps by 2020.[3]

The marketplace has responded to consumer demand and policy initiatives. In the U.S., carriers have managed to match demand for broadband services through access and service layer infrastructure expansions and upgrades. Access infrastructure investments – Fiber-to-the-Node/Curb/Home (FTTx), DSL – will continue to be a multi-billion dollar market segment through 2017. IMS and Voice over Internet Protocol (VoIP) equipment deployments dominate the services layer infrastructure. Industry reports estimate nearly 50% of worldwide IMS/VoIP equipment expenditures will be made in the U.S. by 2017.

As such, the industry growth cited above is mainly focused on enabling high speed data and video service offerings, and much less on facilitating a much-needed PSTN voice network migration to next-generation architecture.

IV. MIGRATING FROM TDM TO IP

In light of current market drivers, carriers are taking steps to understand and adopt joint next-generation voice and broadband migration strategies. There are different perspectives on TDM-IP migration strategies and typically each method considers both access and service

[3]Connecting America: The National Broadband Plan at 25 (2010), available at hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296935A1.pdf.

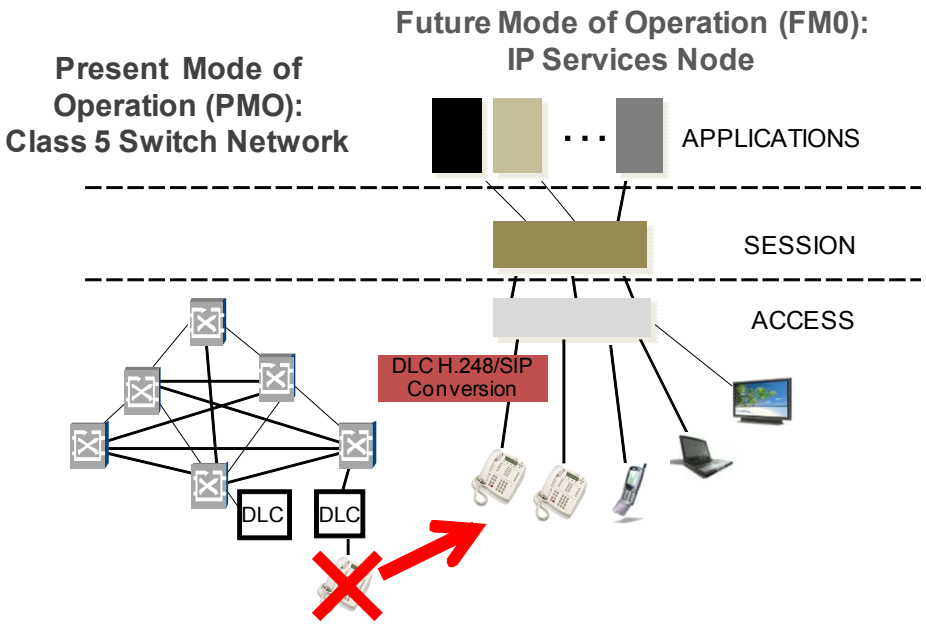
infrastructure modifications. The following addresses the broadband expansion, IP-enabled services and TDM-to-IP migration.

A. PSTN and Broadband Expansion

The most recent TDM voice networks installed during the 1970s and 1980s were digital switching systems with life cycles of approximately 40 years. Today, traditional TDM voice service, or Plain Old Telephone Service (POTS), is typically accessed through digital loop carrier (DLC) or subscriber loop carrier (SLC) facilities. High speed Internet access and video services have driven carrier upgrades of their infrastructure to PON based FTTH, DSL, and DSL-based FTTN access networks. This broadband infrastructure provides the last mile connection to consumers' homes and provides the conduit supporting the replacement of the aging PSTN Class 5 switch voice network with next generation IP-based voice services.

Whereas the TDM Class 5 platform is a distributed service platform with call control and feature functionality, the next generation voice networks are based on IP technologies, providing functional service layers to support enriched features and applications, call session control and media access. As the consumer turns to the increasingly popular services offered by a centralized IP-enabled services platform, the Class 5 network is essentially stranded. Refer to Figure 1.

Figure 1 – Effect of Consumer Migration to IP Services



Assuming the carrier has selected a next generation IP services solution (i.e. IMS), the carrier is now faced with two main concerns: first, assess the broadband infrastructure to determine a strategy for access upgrades; second, determine a strategy for the disposition of the stranded Class 5 assets. The remainder of this section highlights the general access methods considered for broadband expansion. In order to provide access to next generation broadband services such as IP voice, data and video, access methods that have come to general use include:

- DSL/FTTN: Layer 3 devices that are built for the purpose of connecting multiple end users to the Internet via broadband DSL lines, where DSL equipment is located in a central office or in the field in a FTTN architecture; also DSL Customer Premise Equipment (CPE) modems, which are built for the purpose of connecting an individual or a small number of end users to the Internet via broadband DSL lines.
- FTTH: PON, a fiber based, point-to-multipoint architecture that eliminates the use of active electronics between the central office (CO) and customer premises, and includes Ethernet,

Gigabit, Asynchronous Transfer Mode (ATM), and other derivatives; PON CPE or Optical Networking Terminal (ONT) is located at a customer's premise and performs the optical to electrical conversion services such as Ethernet, POTS, and RF video.

Variations of these access methods are part of a carrier's strategy to provide residential, business and metro broadband access services. Although the methods cited above are wireline methods, LTE infrastructure is also being used as a wireline broadband substitute.[4] Wireline CPE devices may also provide wireless access options, such as WiFi or other wireless local area network (WLAN) solutions. A carrier may have to consider a variety of access strategies to support its customer base and the transformation strategy for its PSTN transition.

Generally, wireless TDM-to-IP transformation will follow wireline transformation, but wireless platform migration is worth mentioning in the discussion of TDM-to-IP transformation. As carriers continue to introduce 4G LTE broadband wireless services, they leverage existing legacy 2G/3G sites where possible. This site reuse means that the backhaul network must be scalable enough to support the coexistence and cumulative capacity of LTE with either CDMA or W-CDMA networks. It also means that the backhaul network will need to support a combination of TDM, ATM, and Ethernet/IP traffic while enforcing the control of quality of service (QoS)-related parameters (e.g. jitter and delay) to meet the "deterministic behavior" of TDM circuits when transported over fully-loaded packet links.

In some cases, carriers will leverage existing TDM infrastructure in support of traditional voice services. Carriers who are employing mobile packet transport solution can leverage the same packet transport network for LTE. This gives mobile operators and backhaul providers a

[4] *See, e.g.,* Verizon's HomeFusion fixed LTE substitute at http://www.verizonwireless.com/b2c/homefusion/hf/main.do

clear evolution path to LTE, and allows the coexistence of LTE with previous generations of mobile technologies through cost-effective, converged transport.

In summary, increased demand for wireline and wireless data and video services is causing the consumer to migrate to feature rich IP services. This change in behavior is leaving Class 5 network assets stranded and is driving the demand for new and innovative access infrastructure options.

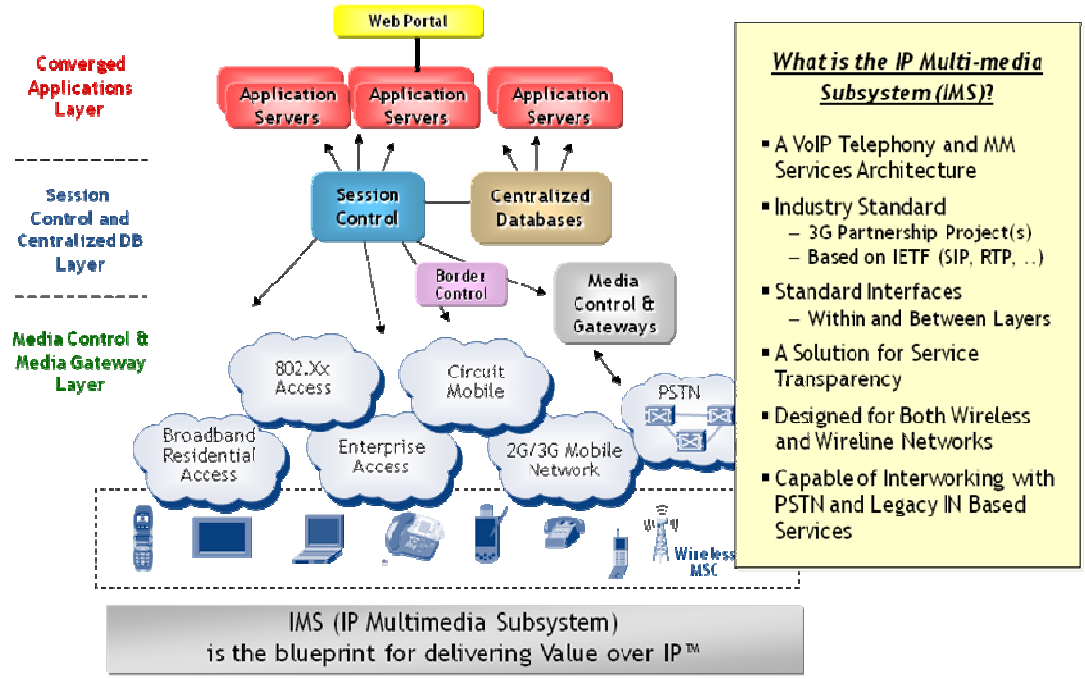
B. IP-Enabled Services and IMS

As access platforms evolve, the market has produced several options to support Class 5 voice services. These service layer solutions, whether driven by Softswitch technology, Over-the-Top VoIP, or IMS not only offer a new portfolio of services but address legacy feature parity. The transition from TDM-based voice service to IP-based voice service can be achieved without any disruption to the vast majority of consumers. It is important to appreciate that not only can equivalent TDM service be offered via the next generation IP networks, but as noted above, end users will greatly benefit from the new service paradigm via many new additional capabilities only available on next generation IP networks.

At the core of the IP-enabled service environment is the IMS platform. Carriers around the world are accepting IMS as the IP-enabled core network to handle next generation voice services. The IMS-based architecture has been defined by the 3rd Generation Partnership Project (3GPP) and the European Telecommunications Standards Institute's (ETSI) Telecoms & Internet converged Services & Protocols for Advanced Network (TISPAN) standards bodies. IMS defines open interfaces between network elements and leverages the Session Initiation Protocol (SIP) for communication. It employs a centralized tier or layered architecture, with applications at the top layer, session control in the center, and media at the bottom layer. IMS functions are

logical elements that can reside on independent chassis or servers for a more distributed solution, or the functions may be integrated on chassis/servers for lower scale solutions. Refer to Figure 2

Figure 2 – Vision of IP-enabled Services through IMS



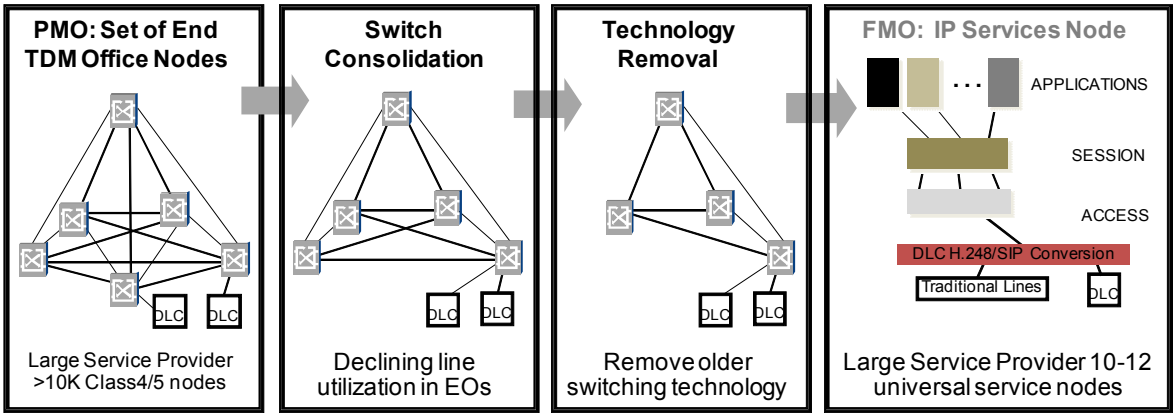
In summary, new IMS networks have been built or are being planned as part of the proliferation of broadband network expansion programs, including LTE deployment. In order to offer the most cost-effective services to their end users, and in order to offer the new IP-based services described above, carriers are focused on building a single services infrastructure utilizing IMS. The new services infrastructure supports access to the network in various ways, including low-speed broadband DSL, FTTx, and LTE. Existing POTS users can be transitioned to voice services via broadband connections, through residential gateways provided to subscribers, or through a line gateway function deployed upstream in the network.

C. Migrating the TDM Switched Voice Network

Alcatel-Lucent has extensive experience supporting technology transitions. Alcatel-Lucent has migrated and transformed networks from analog to digital, circuit to packet, wireline to wireless and from vertically integrated services to next generation IP platforms. To address the ongoing subscriber migration (illustrated in Figure 1) from the traditional TDM switched voice network, carriers are working to develop comprehensive migration programs that minimize PSTN transformation costs, and help realize the benefits of transforming to an IP-enabled network. Alcatel-Lucent has designed a multi-phased PSTN transformation program to ensure a rapid and smooth transition for subscriber migration to new IP platforms. Refer to Figure 3.

Moving subscribers from one platform to another is not a trivial task. The timeline for physical turndown of a large carrier's PSTN network is measured in years. There is significant effort at each wire center to engineer and prepare for a migration from TDM to IP. Alcatel-Lucent estimates the effort required to turn down a wireline switch node includes 15-20 days of planning and engineering, 60-75 days of physical preparation, and 7-14 days of migration and turnover. All in all, approximately 3 to 4 months of effort is required per node. With a team of 12-14 resources handling 10 nodes per year the resource commitment is significant for a network with thousands of Class 5 switches.

Figure 3 – Transformation Approach: TDM Wireline Class 5



Alcatel-Lucent understands the tasks and activities required in IP migration, having developed industry leading methodologies and capabilities. Globally, Alcatel-Lucent has partnered with carriers to provide end-to-end IP migration solutions, including business transformation consulting, network and OSS design, program management, and migration delivery.[5] In serving its customers, Alcatel-Lucent has analyzed operations and developed migration functions and processes. The company maintains state of the art validation lab facilities to ensure operational service readiness, and has multiple patents pending for migration capabilities that support faster and error-free migrations. In addition to partnering with our carrier customers, Alcatel-Lucent also partners with other industry vendors to provide 3rd party solution management. In short, Alcatel-Lucent has migrated millions of subscribers and data service lines to all-IP networks, and will continue to lead the way in this transition.

[5] See, e.g., Telstra at http://www3.alcatel-lucent.com/wps/portal/!ut/p/kcxml/04_Sj9SPykssy0xPLMnMz0vM0Y_QjzKLd4x3tXDUL8h2VAQAURh_Yw!!?LMSG_CABINET=Docs_and_Resource_Ctr&LMSG_CONTENT_FILE=News_Releases_2008/News_Article_001383.xml

V. LEGACY REGULATIONS ARE IMPEDING PROGRESS

Alcatel-Lucent's relationship with the largest carriers across the globe provides insight into the many issues that impede investment in the retirement of TDM networks. Even though studies suggest drivers do exist for PSTN retirement (excess PSTN capacity, high operating costs, obsolete spares and declining knowledge base, etc) carriers often cite regulatory requirements as a top reason for prohibiting full scale PSTN retirement programs. The regulatory policies in place today do not address the new industry order. For example, the centralized, next-generation service environment fundamentally changes the access approach. Today's consumers want their services wherever they are, demanding the freedom to take their account (i.e. phone number) and services with them without regard to LATA or market boundaries. Consumers are demanding everywhere access from a connected omnipresent network, a business environment for which the Class 5 network was simply not designed. This is not considered some niche, cutting edge phenomenon, but a baseline assumption that consumers make about their service with which the telecommunications regulatory framework has failed to keep up.

In one real world example, Alcatel-Lucent performed an intensive three month long economic and technical analysis of one carrier's options for replacing its aging Class 5 infrastructure. Existing regulations required the carrier to host an IP-TDM gateway at all existing central offices with either any active interconnect or 911 PSAP trunk. In today's IP voice market, the most common approach is to centralize such gateways (e.g. 4-8 locations nationwide). Legacy regulatory requirements that have nothing to do with the efficiency of modern day IP networks essentially undermined the economic analysis, as the capital and operating expenses for large numbers of widely distributed, lower capacity gateways was much, much higher than a more scalable, centralized approach.

In another example, a carrier investigating operations planning for a specific PSTN migration determined regulatory obligations associated with legacy voice features required unnecessarily *identical* features to be provided an IP-based replacement. As only one of many examples in this case, the IP-substitute included a nominal number of additional milliseconds of dial tone delay after switchhook closure compared to the legacy solution. While the percentage variation was insignificant with respect to customer quality of service, it was deemed unacceptable due to regulation tied to legacy technology. Ultimately, a lack of 100% equivalent implementation of existing tariffed voice services blocked the carrier's acceptance of the PSTN consolidation and retirement plan, notwithstanding a compelling business case and equivalent service quality. Carriers will be faced with higher maintenance costs as they struggle to consolidate and maintain a separate non-integrated network with equipment over four decades old. A transformation policy that establishes a go-forward environment and regulatory clarity and certainty is in the best interest of the marketplace and consumers.

VI. THE COMMISSION SHOULD PERMIT CARRIERS TO CONDUCT TRIALS TO PREPARE FOR THE TDM-IP TRANSITION

Alcatel-Lucent recommends a gradual phasing out of the TDM network in a manner that provides little to no disruption to consumers. The Commission has an opportunity to support this much anticipated transition. The magnitude of a carrier's transformation will be determined by the size of its network. Following several studies with carrier customers, Alcatel-Lucent has determined that the physical migration and ultimate shut-down of the PSTN network will take a number of years for most carriers to complete. As with any new product, a trial is the typical rite of passage to validate assumptions, measure outcomes and make process improvements. A trial execution of a Class 5 switch node retirement is just as vital as a new product introduction. A

market trial will confirm the assumptions (number of resources, time to execute, disposition of legacy features, etc.) that vendors and carriers have been studying and will put carriers on a path to a controlled, quality shut-down with little to no disturbance to end users. A class 5 switch retirement trial is a key step in understanding the approach to a network-wide PSTN sunset program. In light of ongoing IP network deployments, architectures exist to replace the PSTN platform, and it is time to begin the testing and assessment of PSTN retirement through market trials. Alcatel-Lucent urges the Commission to move quickly to begin this process.

VII. CONCLUSION

For the foregoing reasons, Alcatel-Lucent supports Commission efforts to facilitate the transition from TDM-to-IP, and to permit trials that will assist in a smooth transition.

Respectfully submitted,

Alcatel-Lucent

/s/

Kevin Krufky, Vice President
Jeffrey Marks, Sr. Counsel – Director Regulatory Affairs

Public Affairs, Americas Region
1100 New York, Avenue, N.W.
Suite 640 West Tower
Washington, D.C. 20005

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